Identification of metals and metalloids as hazardous elements in PM2.5 and PM10 collected in a coastal environment affected by diffuse contamination

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Abstract

The nature of the PM2.5 and PM10 varies enormously depending on the anthropogenic activities developed in the surrounding environment. These particles can include Hazardous Elements (HEs), such as heavy metals, which can be considered dangerous for the human health. For this reason, determining the nature of those HEs that are present in the surrounding atmosphere can help to comprehend possible emission sources and to establish new strategies to reduce air pollution. In this work, a cost-effective self-made passive sampler (SMPS) was tested as a tool to collect different size of PM containing metals as HEs. The SMPS was installed in a 20th century historic building (Punta Begona Galleries, Getxo, ~ Basque Country, Spain), located just in front of the sea and thus, immersed in a coastal environment. This location is affected by the activities developed in a marina and in a port, and by the diffuse influence of several industries and a power station. The annual average for PM10 and PM2.5 were approximately 22 mg/m3 and 10 mg/m3, respectively. For develop this study, non-invasive elemental (Scanning Electron Microscope coupled to Energy Dispersive X-ray Spectrometry) and molecular (Raman microscopy) microspectroscopic techniques were used. Thanks to this methodology it was possible to determine in PM10 and PM2.5, the presence of heavy metals such as Fe, Cr, Ti, Pb, Zn, Ce, etc., most of them as oxides but also embedded in different aggregations with aluminosilicates, phosphates, halides, sulfates, etc.

Keywords:

Passive sampler, Particulate matter, Marine aerosol, Hazardous elements, Raman microscopy, SEM-EDS